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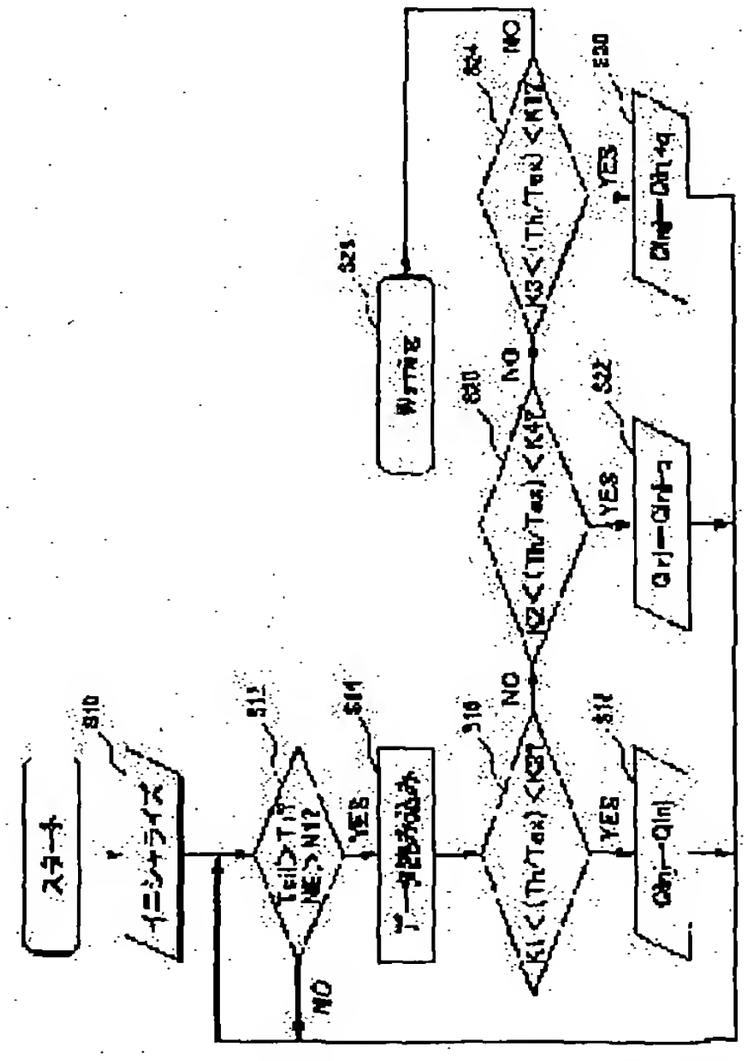
(54) FUEL INJECTION QUANTITY ABNORMALITY DETECTING DEVICE AND FUEL INJECTION QUANTITY CORRECTING DEVICE OF DIESEL ENGINE

(57)Abstract:
PROBLEM TO BE SOLVED: To surely detect an increase-decrease in a fuel injection quantity caused by the degradation with the lapse of time in a injection quantity abnormality detecting device and an injection quantity correcting device of a diesel engine for detecting the occurrence of abnormality and correcting the fuel injection quantity by detecting a change with the lapse of time of the fuel injection quantity caused by long-term use.
SOLUTION: This device is provided with an exhaust gas temperature sensor 24 being arranged in an exhaust gas passage 23 of the diesel engine 10 and detecting an exhaust gas temperature a head temperature sensor 18 for detecting a head temperature of the diesel engine 10, an engine speed sensor 25 and a memory 31 for storing the proper temperature ratio being the ratio of the exhaust gas temperature to an engine temperature in a state of injecting fuel of a target fuel injection quantity with every engine operation state. The actual temperature ratio being the ratio of an actual exhaust gas temperature to an actual engine temperature is arithmetically operated from a detecting result of the respective sensors 18, 24 when operating the engine, and a difference quantity of an actual fuel injection quantity to the target fuel injection quantity is recognized by comparing the proper temperature ratio corresponding to the operation state stored in the memory 31 with the actual temperature ratio. The fuel injection quantity is corrected on the basis of this difference quantity.



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CLAIMS

[Claim(s)]

[Claim 1] Fuel-oil-consumption malfunction detection equipment of a diesel power plant characterized by providing the following. The 1st temperature detection means which is prepared in the flueway of a diesel power plant and detects exhaust gas temperature. The 2nd temperature detection means which detects the engine head temperature of the aforementioned diesel power plant. An operational status detection means to detect the operational status of the aforementioned diesel power plant. The storage means which memorized the proper thermal ratio which is a ratio of the exhaust gas temperature and engine head temperature under the state where the fuel of target fuel oil consumption is injected for every engine operation state, The real thermal ratio which is a ratio of actual exhaust gas temperature and actual engine head temperature is calculated from the above 1st and the detection result of the 2nd temperature detection means during engine operation. An unusual judgment means to judge the abnormalities of actual fuel oil consumption by comparing the aforementioned proper thermal ratio and the aforementioned real thermal ratio corresponding to the **** state concerned memorized for the aforementioned storage means.

[Claim 2] The combustion injection-quantity compensator of a diesel power plant characterized by providing the following. The 1st temperature detection means which is prepared in the flueway of a diesel power plant and detects exhaust gas temperature. The 2nd temperature detection means which detects the engine head temperature of the aforementioned diesel power plant. An operational status detection means to detect the operational status of the aforementioned diesel power plant. The storage means which memorized the proper thermal ratio which is a ratio of the exhaust gas temperature and engine head temperature under the state where the fuel of target fuel oil consumption is injected for every engine operation state, The real thermal ratio which is a ratio of actual exhaust gas temperature and actual engine head temperature is calculated from the above 1st and the detection result of the 2nd temperature detection means during engine operation. A fuel-oil-consumption amendment means to recognize the amount of gaps of the actual fuel oil consumption to the aforementioned target fuel oil consumption, and to amend fuel oil consumption based on this amount of gaps by comparing the aforementioned proper thermal ratio and the aforementioned real thermal ratio corresponding to the **** state concerned memorized for the aforementioned storage means.

[Claim 3] Fuel-oil-consumption malfunction detection equipment of a diesel power plant characterized by providing the following. A firing-pressure detection means to detect the firing pressure of a diesel power plant. An operational status detection means to detect the operational status of the aforementioned diesel power plant. The storage means which memorized the proper firing pressure under the state where the fuel of target fuel oil consumption is injected, for every engine operation state. An unusual judgment means to judge the abnormalities of actual fuel oil consumption by measuring the real firing pressure detected with the aforementioned firing-pressure detection means during engine operation, and the aforementioned proper firing pressure corresponding to the **** state concerned memorized for the aforementioned storage means.

[Claim 4] The fuel-oil-consumption compensator of a diesel power plant characterized by providing the following. A firing-pressure detection means to detect the firing pressure of a diesel power plant. An operational status detection means to detect the operational status of the aforementioned diesel power plant. The storage means which memorized the proper firing pressure under the state where the fuel of target fuel oil consumption is injected, for every engine operation state. A fuel-oil-consumption amendment means to recognize the amount of gaps of the actual fuel oil consumption to the aforementioned target fuel oil consumption, and to amend fuel oil consumption based on this amount of gaps by measuring the real firing pressure detected with the aforementioned firing-pressure detection means during engine operation, and the aforementioned proper firing pressure corresponding to the **** state concerned memorized for the aforementioned storage means.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the injection-quantity malfunction detection equipment and the injection-quantity compensator of a diesel power plant which start the injection-quantity malfunction detection equipment and the injection-quantity compensator of a diesel power plant, especially detect aging of the fuel oil consumption accompanying long-term use, and perform detection of a heterology, and amendment of fuel oil consumption.
[0002]
[Description of the Prior Art] Since thermal efficiency is highly excellent in economical efficiency again, the diesel power plant is widely used as the engine for automobiles, and an engine for aircrafts. Moreover, in recent years, in order to aim at improvement in mpg, and reduction of emission, the diesel power plant in which the fuel-injection control unit which controls the fuel quantity injected from a fuel injection valve using a computer, and rationalizes an air-fuel ratio was carried has become common.
[0003] As a fuel-injection control unit using such an engine control unit (ECU), there are some which were indicated by JP,8-4579,A, for example. The air-fuel ratio sensor which detects the oxygen density contained in exhaust gas is formed in the exhaust pipe, and the fuel-injection control unit indicated by this official report controlled the fuel quantity injected from a fuel injection valve by the oxygen density in the exhaust gas which this air-fuel ratio sensor detects, and was considered as the composition which carries out feedback control of the mixing ratio (A/F) of fuel and air by this so that it may become theoretical air fuel ratio.
[0004]
[Problem(s) to be Solved by the Invention] By the way, by the diesel power plant, an air-fuel ratio is remarkable RIN compared with a gasoline engine. For this reason, the injection-quantity amendment based on an air-fuel ratio sensor at a diesel power plant is difficult. This is because a limitation is in the value of RIN which can detect an air-fuel ratio sensor.
[0005] Moreover, by the diesel power plant, fuel pressurized with the plunger in a fuel injection pump is considered as the composition fed by the diesel power plant, when a fuel spill valve closes the valve to the timing of fuel injection. This plunger is energized by the face cam rotated synchronizing with the crankshaft of a diesel power plant, is driven, and is considered as the composition which pressurizes fuel.
[0006] However, it is possible with long-term use of a fuel injection pump that wear or deposition of discard occurs with time in the slide contact position of a face cam and a plunger. Thus, if wear and deposition with time occur, fuel oil consumption will fluctuate and it will shift from target fuel oil consumption. By this, when fuel oil consumption increases, a smoke and emission increase, and when fuel oil consumption decreases conversely, an engine output will decline.
[0007] Moreover, when it is going to detect the change in the fuel oil consumption accompanying this degradation with the passage of time, at the former, a method only has judging only from the detection result of an air-fuel ratio sensor. However, as mentioned above, since an air-fuel ratio sensor had a limitation in the detection range, it could not detect the change in the fuel oil consumption accompanying degradation with the passage of time with a sufficient precision, and had the trouble that amendment to the change in fuel oil consumption could not be performed, either.
[0008] this invention is made in view of the above-mentioned point, and if operational status is decided, it will aim at offering the injection-quantity malfunction detection equipment and the injection-quantity compensator of a diesel power plant which can detect certainly the change in the fuel oil consumption accompanying degradation with the passage of time by detecting the change in fuel oil consumption using the parameter (engine property) which shows a fixed property change according to change of fuel oil consumption.

[0009]
[Means for Solving the Problem] The above-mentioned technical problem is solvable by providing each means expressed below. The injection-quantity malfunction detection equipment of the diesel power plant concerning invention according to claim 1 The 1st temperature detection means which is prepared in the flueway of a diesel power plant and detects exhaust gas temperature, The 2nd temperature detection means which detects the engine head temperature of the aforementioned diesel power plant, An operational status detection means to detect the operational status of the aforementioned diesel power plant, The storage means which memorized the proper thermal ratio which is a ratio of the exhaust gas temperature and engine head temperature under the state where the fuel of target fuel oil consumption is injected for every engine operation state, The real thermal ratio which is a ratio of actual exhaust gas temperature and actual engine head temperature is calculated from the above 1st and the detection result of the 2nd temperature detection means during engine operation. By comparing the aforementioned proper thermal ratio and the aforementioned real thermal ratio corresponding to the **** state concerned memorized for the aforementioned storage means, it is characterized by having an unusual judgment means to judge the abnormalities of actual fuel oil consumption.
[0010] in the above-mentioned composition, the ratio (Th/Tex: -- it is also possible to use this inverse number) of the exhaust gas temperature (Tex) detected by the 1st temperature detection means and the engine head temperature (Th) detected by the 2nd temperature detection means shows the value mostly decided by operational status (for example, an engine speed, a load, etc.) of a diesel power plant Moreover, this thermal ratio (Th/Tex) is a stable value which does not change even if an ambient condition changes a little.
[0011] On the other hand, fuel oil consumption has exhaust gas temperature (Tex) and engine head temperature (Th), and a correlation, and when fuel oil consumption specifically increases, both exhaust gas temperature (Tex) and engine head temperature (Th) increase. Therefore, the thermal ratio (Th/Tex) which is a ratio of exhaust gas temperature (Tex) and engine head temperature (Th) is a value which changes according to fuel oil consumption.
[0012] Therefore, it can judge whether the present fuel oil consumption has shifted from target fuel oil consumption by memorizing for the storage means for every engine operation state by making into a proper thermal ratio the thermal ratio (Th/Tex) under the state where fuel injection of target fuel oil consumption is carried out, calculating the thermal ratio (Th/Tex) of the diesel power plant operated now, and comparing this calculated real thermal ratio with a proper thermal ratio.
[0013] An unusual judgment means compares a proper thermal ratio with a real thermal ratio, and when both amount of gaps is large, it is judged that abnormalities occurred. Thereby, degradation with the passage of time occurs in a fuel pump, and it can recognize that detected this certainly and abnormalities occurred even if it was a case as fuel oil consumption shifted from target fuel oil consumption in connection with this.
[0014] Moreover, the fuel-oil-consumption compensator of the diesel power plant concerning invention according to claim 2 The 1st temperature detection means which is prepared in the flueway of a diesel power plant and detects exhaust gas temperature, The 2nd temperature detection means which detects the engine head temperature of the aforementioned diesel power plant, An operational status detection means to detect the operational status of the aforementioned diesel power plant, The storage means which memorized the proper thermal ratio which is a ratio of the exhaust gas temperature and engine head temperature under the state where the fuel of target fuel oil consumption is injected for every engine operation state, The real thermal ratio which is a ratio of actual exhaust gas temperature and actual engine head temperature is calculated from the above 1st and the detection result of the 2nd temperature detection means during engine operation. By comparing the aforementioned proper thermal ratio and the aforementioned real thermal ratio corresponding to the **** state concerned memorized for the aforementioned storage means The amount of gaps of the actual fuel oil consumption to the aforementioned target fuel oil consumption is recognized, and it is characterized by having a fuel-oil-consumption amendment means to amend fuel oil consumption based on this amount of gaps.
[0015] Also in invention considered as the above-mentioned composition, it memorizes for the storage means for every engine operation state like invention according to claim 1 by making into a proper thermal ratio the thermal ratio (Th/Tex) under the state where fuel injection of target fuel oil consumption is carried out. It can judge whether the present fuel oil consumption has shifted from target fuel oil consumption by calculating the thermal ratio (Th/Tex) of the diesel power plant operated now, and comparing this calculated real thermal ratio with a proper thermal ratio.
[0016] By comparing a proper thermal ratio with a real thermal ratio, a fuel-oil-consumption amendment means recognizes the amount of gaps of the actual fuel oil consumption to target fuel oil consumption, and amends fuel oil consumption based on this amount of gaps. Though actual fuel oil consumption could be brought close to target fuel oil consumption by this, for example, degradation with the passage of time has occurred in the fuel injection pump, an ideal air-fuel ratio can be realized, and the increase in a smoke and emission and the loss of power of an engine can be

suppressed.

[0017] The injection-quantity malfunction detection equipment of the diesel power plant concerning invention according to claim 3 A firing-pressure detection means to detect the firing pressure of a diesel power plant, and an operational status detection means to detect the operational status of the aforementioned diesel power plant, The storage means which memorized the proper firing pressure under the state where the fuel of target fuel oil consumption is injected, for every engine operation state, It is characterized by having an unusual judgment means to judge the abnormalities of actual fuel oil consumption by measuring the real firing pressure detected with the aforementioned firing-pressure detection means during engine operation, and the aforementioned proper firing pressure corresponding to the **** state concerned memorized for the aforementioned storage means.

[0018] In the above-mentioned composition, the firing pressure detected by the firing-pressure detection means shows the value mostly decided by operational status (for example, an engine speed, a load, etc.) of a diesel power plant. Moreover, this firing pressure is a stable value which does not change even if an ambient condition changes a little.

[0019] On the other hand, fuel oil consumption has a correlation in a firing pressure, and when fuel oil consumption specifically increases, a firing pressure increases. Therefore, it can judge whether the present fuel oil consumption has shifted from target fuel oil consumption by memorizing for the storage means for every engine operation state by making into a proper firing pressure the firing pressure under the state where fuel injection of target fuel oil consumption is carried out, detecting the firing pressure of the diesel power plant operated now, and measuring this detected real firing pressure with a proper firing pressure.

[0020] An unusual judgment means measures a proper firing pressure and a real firing pressure, and when both amount of gaps is large, it is judged that abnormalities occurred. Thereby, degradation with the passage of time occurs in a fuel pump, and it can recognize that detected this certainly and abnormalities occurred even if it was a case as fuel oil consumption shifted from target fuel oil consumption in connection with this.

[0021] The fuel-oil-consumption compensator of the diesel power plant concerning invention according to claim 4 A firing-pressure detection means to detect the firing pressure of a diesel power plant, and an operational status detection means to detect the operational status of the aforementioned diesel power plant, The storage means which memorized the proper firing pressure under the state where the fuel of target fuel oil consumption is injected, for every engine operation state, By measuring the real firing pressure detected with the aforementioned firing-pressure detection means during engine operation, and the aforementioned proper firing pressure corresponding to the **** state concerned memorized for the aforementioned storage means The amount of gaps of the actual fuel oil consumption to the aforementioned target fuel oil consumption is recognized, and it is characterized by having a fuel-oil-consumption amendment means to amend fuel oil consumption based on this amount of gaps.

[0022] Also in invention considered as the above-mentioned composition, it memorizes for the storage means for every engine operation state like invention according to claim 3 by making into a proper firing pressure the firing pressure under the state where fuel injection of target fuel oil consumption is carried out. It can judge whether the present fuel oil consumption has shifted from target fuel oil consumption by detecting the firing pressure of the diesel power plant operated now, and measuring this real firing pressure and proper firing pressure that were detected.

[0023] By measuring a proper firing pressure and a real firing pressure, a fuel-oil-consumption amendment means recognizes the amount of gaps of the actual fuel oil consumption to target fuel oil consumption, and amends fuel oil consumption based on this amount of gaps. Though actual fuel oil consumption could be brought close to target fuel oil consumption by this, for example, degradation with the passage of time has occurred in the fuel injection pump, an ideal air-fuel ratio can be realized, and the increase in a smoke and emission and the loss of power of an engine can be suppressed.

[0024]

[Embodiments of the Invention] Next, the gestalt of operation of this invention is explained with a drawing.

[0025] Drawing 1 shows the diesel power plant 10 in which the fuel-oil-consumption malfunction detection equipment concerning this invention and a fuel-oil-consumption compensator are carried. The diesel power plant 10 shown in this drawing is air cooling, for example, is used as an engine for aircrafts.

[0026] The diesel power plant 10 of this example is mentioning the six cylinder engine as the example, and, therefore, six cylinders 12 are formed. A piston, a combustion chamber, etc. which do not appear in drawing, respectively are established in each of this cylinder 12.

[0027] Moreover, the radiation fin 13 is formed in the periphery position of a cylinder 12. Furthermore, the fuel injection valve 19 is arranged in each combustion chamber, respectively, and this fuel injection valve 19 is connected to the fuel injection pump 20 through the injection pipe 21.

[0028] The fuel spill valve which a fuel injection pump 20 turns to the injection pipe 21 the plunger which pressurizes fuel, the cam mechanism which is connected to the crankshaft of a diesel power plant 10, and drives a plunger, and the

fuel pressurized with the plunger to predetermined timing, and is fed is arranged.
[0029] A plunger is energized by the face cam rotated synchronizing with the crankshaft of a diesel power plant, is driven, and is considered as the composition which pressurizes fuel. And when a fuel spill valve closes the valve, the fuel heated with the plunger is fed towards the injection pipe 21, and is injected by the combustion chamber from a fuel injection valve 19.
[0030] Under the present circumstances, opening and closing of a fuel spill valve are controlled by the engine control unit 30 (henceforth ECU). The various sensors for ECU30 detecting an engine operation state are connected. Specifically, the engine oil ** sensor 17 which performs temperature detection of lubricous oil, the head thermo sensor 18 which detects the head temperature of a cylinder 12, and the various sensors containing the engine-speed-sensor 25 grade which detects an engine speed (NE) are connected to ECU30.
[0031] And based on the detection result of these various sensors, ECU30 computes the fuel oil consumption (this fuel oil consumption is hereafter called target fuel oil consumption) which was most suitable for the present engine operation state, and it carries out drive control of the fuel spill valve so that the fuel oil consumption injected from a fuel injection valve 19 may turn into this target fuel oil consumption. In addition, target fuel oil consumption has little smoke and emission, and is fuel oil consumption which the fall of an engine output does not generate here.
[0032] Moreover, the suction manifold 16 and the exhaust manifold 22 are formed, an inlet pipe 14 is connected to a suction manifold 16, and the diesel power plant 10 is considered as the composition to which the exhaust pipe 23 was connected at the exhaust manifold 22. The air cleaner 15 which purifies the air inhaled is arranged by the inlet pipe 14. Moreover, the inhalation-of-air throttle valve (not shown) which controls the air content inhaled is prepared in the inlet pipe 14. On the other hand, the exhaust air thermo sensor 24 which measures the temperature of exhaust gas is arranged by the exhaust pipe 23. In this example, since it is the composition that the exhaust pipe 23 was formed for every 3 cylinder, the exhaust air thermo sensor 24 is formed in each exhaust pipe 23, respectively.
[0033] By the way, as mentioned above, ECU30 computes the fuel oil consumption (this fuel oil consumption is hereafter called target fuel oil consumption) which was most suitable for the present engine operation state based on the detection result of the various sensors arranged by the diesel power plant 10 and the fuel injection pump 20, and it carries out drive control of the fuel spill valve so that the fuel oil consumption injected from a fuel injection valve 19 may turn into this target fuel oil consumption.
[0034] Specifically, ECU30 is considered as the composition which controls fuel oil consumption by controlling the time (namely, time which is carrying out fuel injection) which is closing the fuel spill valve. This fuel-injection control is premised on the fuel quantity fed by the fuel injection valve 19 from a fuel injection pump 20 being stable. That is, when target fuel oil consumption was temporarily set to W, a fuel spill valve closes the valve and fuel quantity per [which is fed by the fuel injection valve 19 from a fuel injection pump 20] unit time is set to V, by calculating W/V, ECU30 calculates fuel injection duration T (=W/V), and is considered as the composition only whose time T of this closes a fuel spill valve.
[0035] However, it follows on long-term use of a fuel injection pump 20 as mentioned above. If wear with time, deposition of discard, etc. occur in the slide contact position of a cam mechanism and a plunger etc. The fuel quantity V per [which is fed by the fuel injection valve 19] unit time is changed from (these phenomena are hereafter called degradation with the passage of time) and a fuel injection pump 20. The situation where the fuel quantity (this fuel quantity injected in fact is hereafter called real fuel oil consumption) actually injected from a fuel injection valve 19 shifts from target fuel oil consumption occurs. When the gap of such fuel oil consumption occurred and fuel oil consumption increases, a smoke and emission increase, and when fuel oil consumption decreases conversely, an engine output will decline.
[0036] In this example, ECU30 is considering as the composition which emits warning which tells a heterology for the gap with target fuel oil consumption and real fuel oil consumption with an amendment when this amount of gaps is large based on the exhaust gas temperature (Tex) detected by the exhaust air thermo sensor 24 (1st temperature detection means) and the head temperature (Th) detected by the head thermo sensor 18 (2nd temperature detection means).
[0037] Hereafter, the fuel-oil-consumption amendment processing which ECU30 carries out, and fuel-injection malfunction detection processing are explained.
[0038] First, the principle of this example is explained using drawing 3 . Drawing 3 shows the relation between a thermal ratio (Th/Tex) and an engine speed (NE) by taking the thermal ratio (Th/Tex) of the exhaust gas temperature (Tex) detected by the exhaust air thermo sensor 24 and the head temperature (Th) detected by the head thermo sensor 18 along a vertical axis, and taking an engine speed (NE) along a horizontal axis. It can ask for the relation of this thermal ratio (Th/Tex) and engine speed (NE) by experimenting to a diesel power plant 10 beforehand.
[0039] the ratio (Th/Tex: -- it is also possible to use this inverse number) of this exhaust gas temperature (Tex) and

head temperature (Th) shows the value mostly decided by operational status (for example, an engine speed, a load, etc.) of a diesel power plant 10 Moreover, this thermal ratio (Th/Tex) is a stable value which does not change even if an ambient condition changes a little. Then, by drawing 3 , an engine speed (NE) is taken as a parameter which shows the operational status of a diesel power plant 10, and the relation between this and a thermal ratio (Th/Tex) is shown. As shown in this drawing, a thermal ratio (Th/Tex) shows the property which increases a little in connection with an engine speed (NE) increasing.

[0040] On the other hand, fuel oil consumption has exhaust gas temperature (Tex) and head temperature (Th), and the correlation. Specifically, when fuel oil consumption increases, a thermal load increases and both exhaust gas temperature (Tex) and head temperature (Th) show the increasing property (however, the rate of increase differs mutually). Therefore, a thermal ratio (Th/Tex) serves as a value which changes according to fuel oil consumption. This phenomenon appears notably especially in the air-cooled engine which does not perform forced cooling with cooling water etc.

[0041] Therefore, while memorizing in the memory 31 (storage means) of ECU30 for every engine operation state by making into a proper thermal ratio the thermal ratio (Th/Tex) under the state where fuel injection of target fuel oil consumption is carried out The present fuel oil consumption becomes possible [judging whether it has shifted from target fuel oil consumption] by calculating the thermal ratio (this being hereafter called real thermal ratio) of the diesel power plant 10 operated now, and comparing this real thermal ratio and proper thermal ratio that were calculated.

[0042] When asking for the relation of the engine speed (NE) and thermal ratio (Th/Tex) which are shown in drawing 3 in this example, The relation between the engine speed (NE) when performing fuel injection of target fuel oil consumption to the diesel power plant 10 it was confirmed to be that degradation with the passage of time had not occurred, and a thermal ratio (Th/Tex), When changing fuel oil consumption to target fuel oil consumption, two of the relations of the engine speed (NE) and thermal ratio (Th/Tex) which are the limitation that operation with a proper diesel power plant 10 can be maintained are calculated. In drawing 3 , K1 shows the property of the minimum when performing fuel injection of the above-mentioned **, and K2 shows the maximum property. Moreover, K3 shows the property of the minimum when performing fuel injection of the above-mentioned **, and K4 shows the maximum property.

[0043] Therefore, the engine speed of the diesel power plant 10 with present on stream is NE1, and if the real thermal ratio (Th/Tex) at this time is in the field between [which is shown in drawing 3] K1 and K2 (namely, inside of the field shown by the arrow A1 in drawing), it can be judged that target fuel oil consumption and real fuel oil consumption are in agreement. under this state, it described above in the fuel injection pump 20 grade -- passing -- the time -- degradation -- being generated -- if -- not breaking -- moreover, it will be in the good operational status (this operational status is hereafter called proper operational status) which generating of a smoke and emission and the fall of an engine output do not have, either

[0044] Moreover, an engine speed is NE1, and when the real thermal ratio (Th/Tex) at this time is in the field between [which is shown in drawing 3] K1 and K3 (namely, inside of the field shown by the arrow A2 in drawing), it can be judged that target fuel oil consumption and real fuel oil consumption have shifted. however -- if it is in this field A2 -- fuel oil consumption -- an amendment -- it is possible to consider as proper operational status by things concrete -- this case -- a fitness thermal ratio -- receiving -- a real thermal ratio -- a low sake -- fuel oil consumption -- an increase-in-quantity amendment -- it can consider as proper operational status by things

[0045] Moreover, an engine speed is NE1, and when the real thermal ratio (Th/Tex) at this time is in the field between [which is shown in drawing 3] K2 and K4 (namely, inside of the field shown by the arrow A3 in drawing), it can be judged that target fuel oil consumption and real fuel oil consumption have shifted. however, the case where a real thermal ratio is in a field A3 -- fuel oil consumption -- an amendment -- it is possible to consider as proper operational status by things concrete -- this case -- a fitness thermal ratio -- receiving -- since the real thermal ratio is high -- fuel oil consumption -- a loss-in-quantity amendment -- it can consider as proper operational status by things

[0046] Moreover, an engine speed is NE1, and when the real thermal ratio (Th/Tex) at this time is in less than [K3] which is shown in drawing 3 , or the field (namely, inside of the field shown in the arrow A4 in drawing, and A5) which is more than K4, it can be judged that target fuel oil consumption and real fuel oil consumption are shifted greatly. Thus, when target fuel oil consumption and real fuel oil consumption are shifted greatly, degradation with the passage of time is progressing violently, and it cannot respond in amendment processing of fuel oil consumption. Therefore, in this example, it is considering as the composition which emits warning in this case.

[0047] Then, the fuel-oil-consumption malfunction detection processing and fuel-oil-consumption amendment processing which ECU30 carries out based on the above-mentioned principle are explained.

[0048] Drawing 2 is a flow chart which shows the fuel-oil-consumption malfunction detection processing and fuel-oil-consumption amendment processing which ECU30 carries out. Starting of the processing shown in this drawing

performs initialization processing in Step 10 (drawing, the step is called S for short) first. Initialization processing is processing which initializes the various parameters (exhaust gas temperature (Tex), head temperature (Th), engine oil ** (Toil), etc.) used by the processing after Step 12 here.
[0049] An end of processing of Step 10 judges whether engine oil ** (Toil) continuously detected by the engine oil ** sensor 17 in Step 12 is more than predetermined temperature (T1), or the engine speed NE detected by the engine speed sensor 25 is more than a predetermined rotational frequency (N1).
[0050] When negative judgment is carried out at Step 12, a diesel power plant 10 forbids the fuel-oil-consumption malfunction detection processing and fuel-oil-consumption amendment processing after Step 14 until warming up is completed, since it is in the unstable state which warming up has not ended. If it is judged that warming up was completed at Step 12, processing will progress to Step 14.
[0051] At Step 14, the present exhaust gas temperature (Tex) is detected from the exhaust air thermo sensor 24, the present head temperature (Th) is detected from the head thermo sensor 18, and the present engine speed NE is detected from an engine speed sensor 25. Moreover, ECU30 calculates the real thermal ratio (Th/Tex) which is a ratio of the present exhaust gas temperature (Tex) and the present head temperature (Th).
[0052] At each continuing step of Steps 16, 220, and 24, comparison processing with the map (map in which the relation between an engine speed and a thermal ratio is shown) shown in drawing 3 memorized in the memory 31 of ECU30 is performed. Field where the real thermal ratio (Th/Tex) was inserted into K1 and K2 which were shown in drawing 3 at Step 16 (K1<(Th/Tex) <K2) It judges whether it is located or not. The state where affirmative judgment was performed at Step 16 is the case where a real thermal ratio (Th/Tex) is in the field shown by the arrow A1 of drawing 3 . Therefore, in this operational status, target fuel oil consumption and real fuel oil consumption are in agreement, and it can be judged that degradation with the passage of time is not generated in fuel injection pump 20 grade. Therefore, when affirmative judgment is carried out at Step 16, in Step 18, the present injection quantity (Qinj) is maintained as it is, and it is considering as the composition which ends this processing.
[0053] On the other hand, if negative processing is carried out at Step 16, processing will progress to Step 20. Field where the real thermal ratio (Th/Tex) was inserted into K2 and K4 which were shown in drawing 3 at Step 20 (K2< (Th/Tex) <K4) It judges whether it is located or not. The state where affirmative judgment was performed at Step 20 is the case where a real thermal ratio (Th/Tex) is in the field shown by the arrow A3 of drawing 3 . [0054] although, as for this operational status, real fuel oil consumption has shifted to target fuel oil consumption -- fuel oil consumption -- a loss-in-quantity amendment -- it is in the state which can be made into proper operational status by things -- it can judge Moreover, although degradation with the passage of time may also be generated a little, it can be judged that it is in the state where the grade which poses a problem immediately is not progressing. Moreover, when affirmative judgment is performed at Step 20, since a real thermal ratio is in a high state to a fitness thermal ratio, it sets to Step 22, and only the specified quantity (q) is a loss-in-quantity amendment about the present injection quantity (Qinj). Thereby, operational status can be brought close to proper operational status.
[0055] On the other hand, if negative processing is carried out at Step 20, processing will progress to Step 24. Field where the real thermal ratio (Th/Tex) was inserted into K1 and K3 which were shown in drawing 3 at Step 24 (K3< (Th/Tex) <K1) It judges whether it is located or not. The state where affirmative judgment was performed at Step 24 is the case where a real thermal ratio (Th/Tex) is in the field shown by the arrow A2 of drawing 3 .
[0056] although real fuel oil consumption has shifted to target fuel oil consumption also in this operational status -- fuel oil consumption -- a loss-in-quantity amendment -- although it could judge and degradation with the passage of time may also be generated a little, it can be judged that it is in the state where the grade which is in the state which can be made into proper operational status by things and which poses a problem immediately is not progressing Moreover, when affirmative judgment is performed at Step 24, it sets to Step 26 which continues since a real thermal ratio is in a low state to a fitness thermal ratio, and only the specified quantity (q) is an increase-in-quantity amendment about the present injection quantity (Qinj). Thereby, operational status can be brought close to proper operational status.
[0057] On the other hand, the state where negative processing was carried out also in Step 24 is in less than [K3] (field shown by the arrow A4) which the real thermal ratio (Th/Tex) showed to drawing 3 , or the state located more than K4 (field shown in arrow A5). In this state, it can be judged that target fuel oil consumption and real fuel oil consumption are shifted greatly. As described above, when target fuel oil consumption and real fuel oil consumption are shifted greatly in this way, degradation with the passage of time is progressing violently, and it cannot respond in amendment processing of fuel oil consumption. Therefore, when negative judgment is carried out at Step 24, processing progresses to Step 28 and is considered as the composition which emits warning by this example.
[0058] A proper thermal ratio is compared with a real thermal ratio, as described above, by this example, when both amount of gaps is large, it judges that abnormalities occurred, and it is considering as the composition which emits warning. therefore, for example, fuel pump 20 grade -- passing -- the time -- degradation -- generating -- this --

following -- fuel oil consumption -- from target fuel oil consumption -- having shifted -- as -- a case -- it is -- even if -- this -- certain -- detecting -- abnormalities -- having generated -- things -- a pilot wave -- certain -- it can tell about .
Moreover, in this example, by comparing a real thermal ratio with a proper thermal ratio, the gap of actual fuel oil consumption to target fuel oil consumption is recognized, and when this gap has arisen, it is considering as the composition which amends fuel oil consumption in Steps 22 and 26. Therefore, though degradation with the passage of time has occurred, for example in the fuel injection pump, an ideal air-fuel ratio can be realized, and the increase in a smoke and emission and the loss of power of an engine can be suppressed.
[0059] Next, the 2nd example of this invention is explained.
[0060] Drawing 4 is a flow chart which shows the fuel-oil-consumption malfunction detection processing and fuel-oil-consumption amendment processing concerning the 2nd example of this invention, and drawing 5 shows the relation between a firing pressure and an engine speed in order to explain the principle of this example. In addition, in drawing 4 , the same number of steps is attached about the same processing as the processing shown in drawing 2 , and Sign A is written about a different step.
[0061] In said 1st example, it considered as the composition which notifies of amendment of fuel oil consumption, and generating of abnormalities by comparing a present real thermal ratio and a present proper thermal ratio paying attention to the value it was mostly decided by the operational status (engine speed) of a diesel power plant 10 that the thermal ratio (Th/Tex) which is a ratio of exhaust gas temperature (Tex) and head temperature (Th) would be being shown, and a thermal ratio (Th/Tex) changing according to fuel oil consumption.
[0062] However, there is another parameter which shows the value mostly decided by operational status of a diesel power plant 10. In this example, it is characterized by performing fuel-oil-consumption malfunction detection processing and fuel-oil-consumption amendment processing among such parameters using a firing pressure (process variable).
[0063] That is, a firing pressure (process variable) shows the value mostly decided by operational status of a diesel power plant 10 like the thermal ratio (Th/Tex), and a firing pressure (process variable) changes according to fuel oil consumption. Therefore, the same effect as the 1st example is realizable also by replacing with and using a firing pressure (process variable) for a thermal ratio (Th/Tex).
[0064] In Steps 16A, 20A, and 24A shown in drawing 4 , K1-K4, and the present firing pressure (real firing pressure) are specifically measured, and it judges whether this real firing pressure is in which field (A1 - A5) shown in drawing 5 , and is considering as the composition which performs the same processing as the 1st example. Therefore, degradation with the passage of time generated in fuel pump 20 grade also by this example is certainly detectable, and though degradation with the passage of time has occurred in the fuel injection pump 20 grade, an ideal air-fuel ratio can be realized, and it becomes possible to suppress the increase in a smoke and emission, and the loss of power of an engine.
[0065]
[Effect of the Invention] this invention can realize the various effect described below. According to a claim 1 and invention according to claim 3, degradation with the passage of time occurs, for example in a fuel pump, and it can recognize that detected this certainly and abnormalities occurred even if it was a case as fuel oil consumption shifted from target fuel oil consumption in connection with this.
[0066] moreover, the thing for which a fuel-oil-consumption amendment means compares a proper thermal ratio with a real thermal ratio according to a claim 2 and invention according to claim 4 -- or since the amount of gaps of the actual fuel oil consumption to target fuel oil consumption is recognized and fuel oil consumption is amended by measuring a proper firing pressure and a real firing pressure, actual fuel oil consumption can be brought close to target fuel oil consumption therefore, a fuel injection pump -- passing -- the time -- degradation -- generating -- **** -- ****** -- an ideal air-fuel ratio -- realizable -- a smoke and emission -- it becomes possible to suppress an increase and the loss of power of an engine

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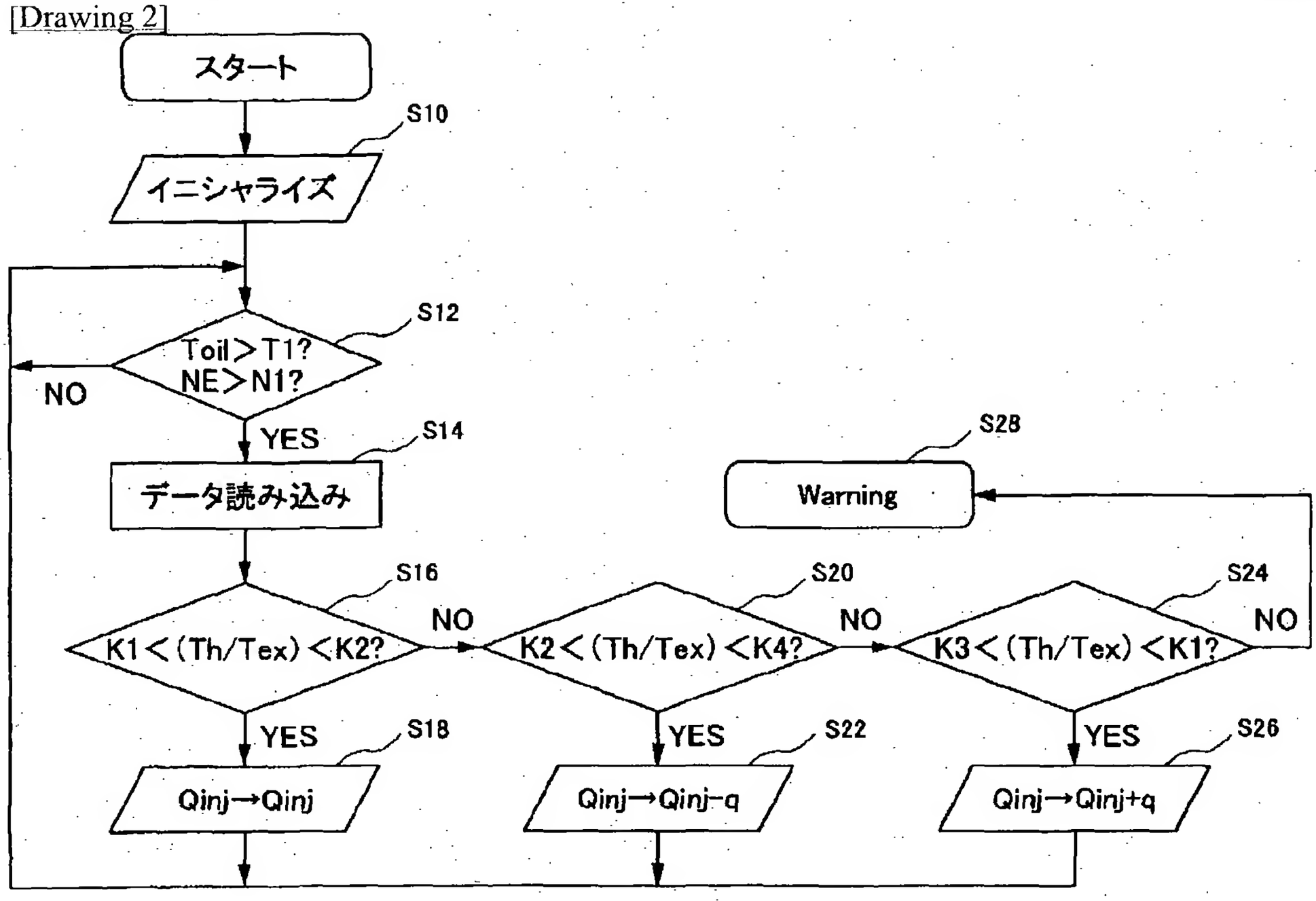
[Translation done.]

* NOTICES *

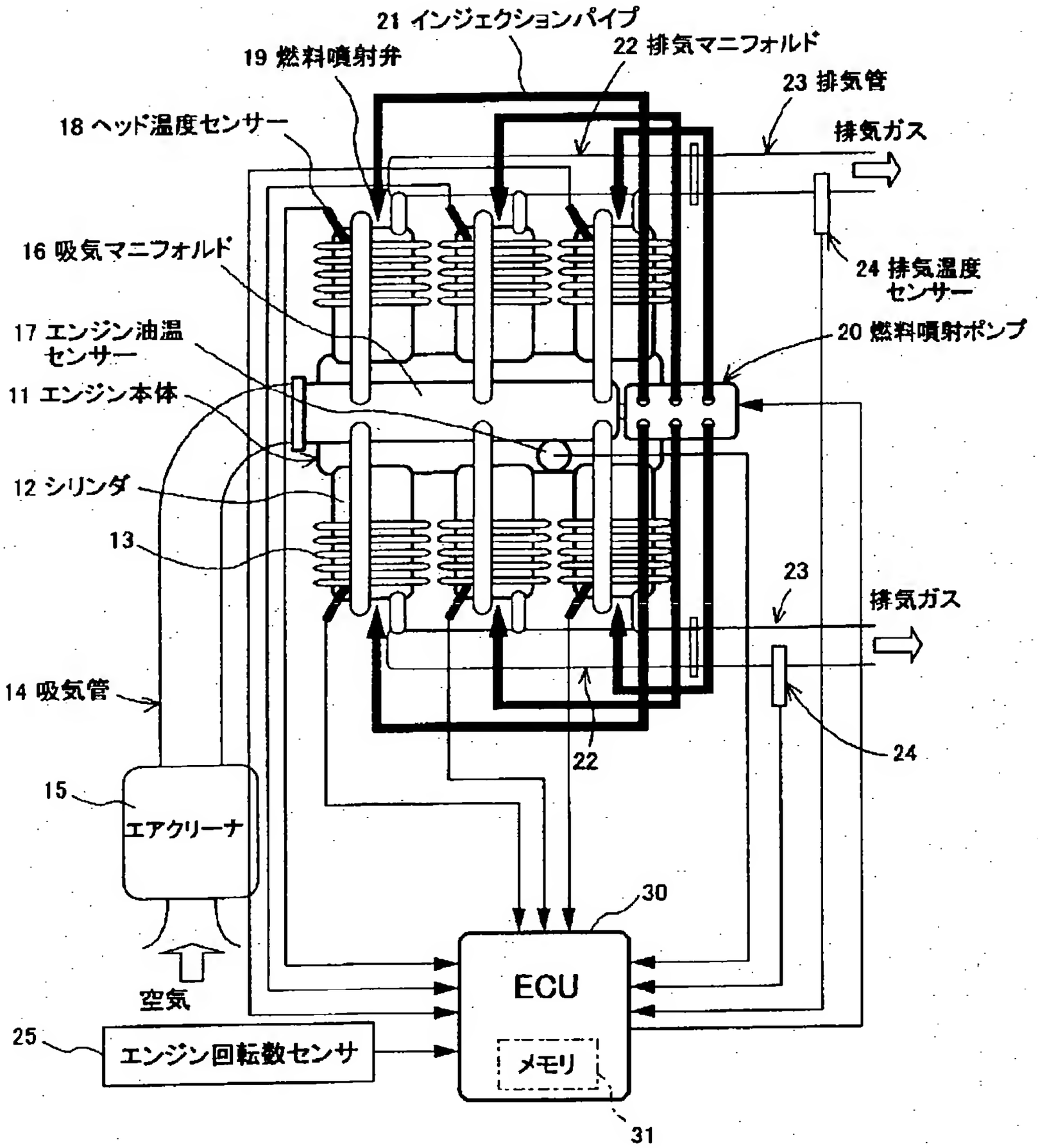
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

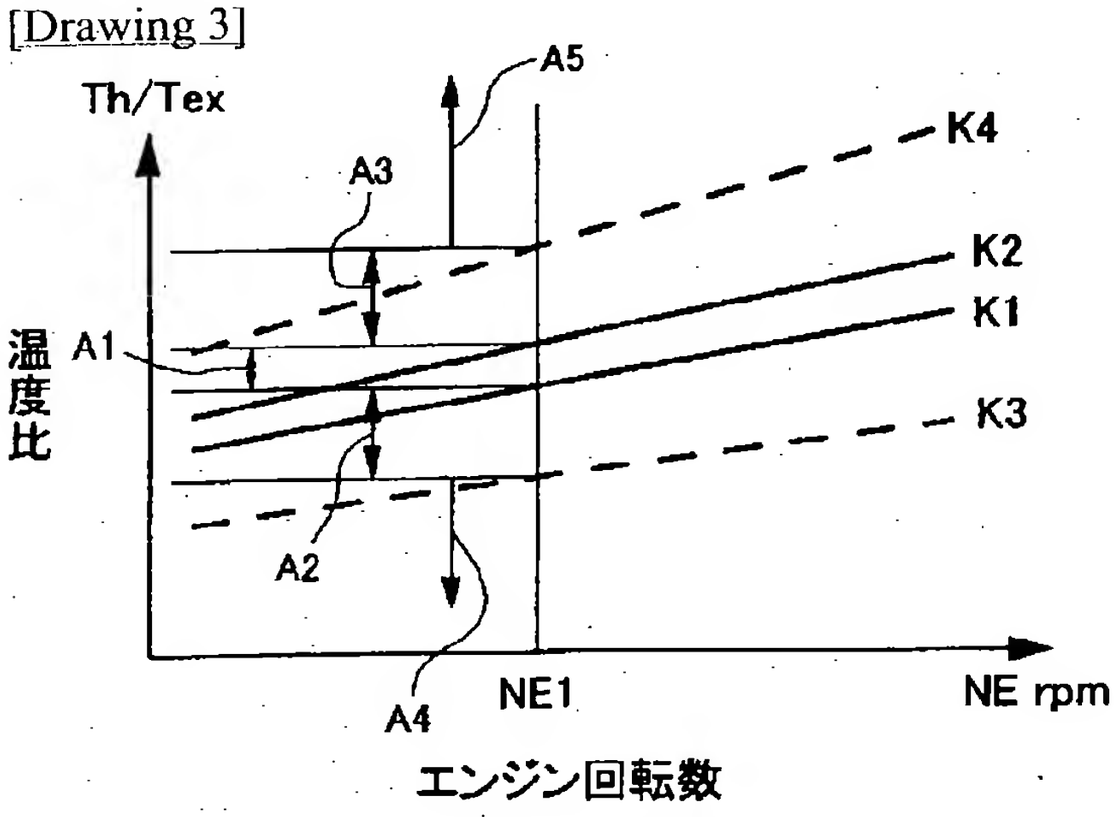
[Drawing 2]



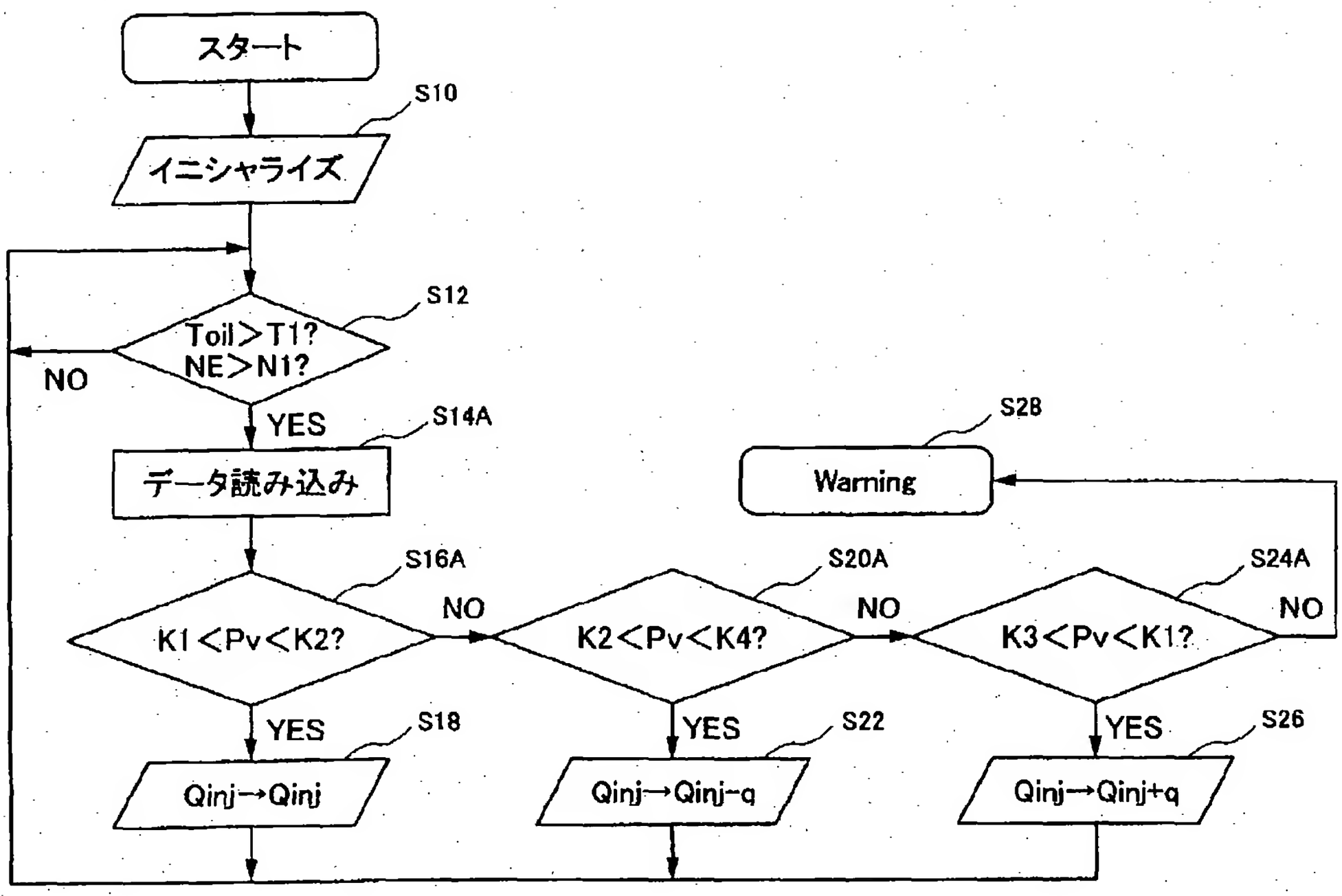
[Drawing 1]



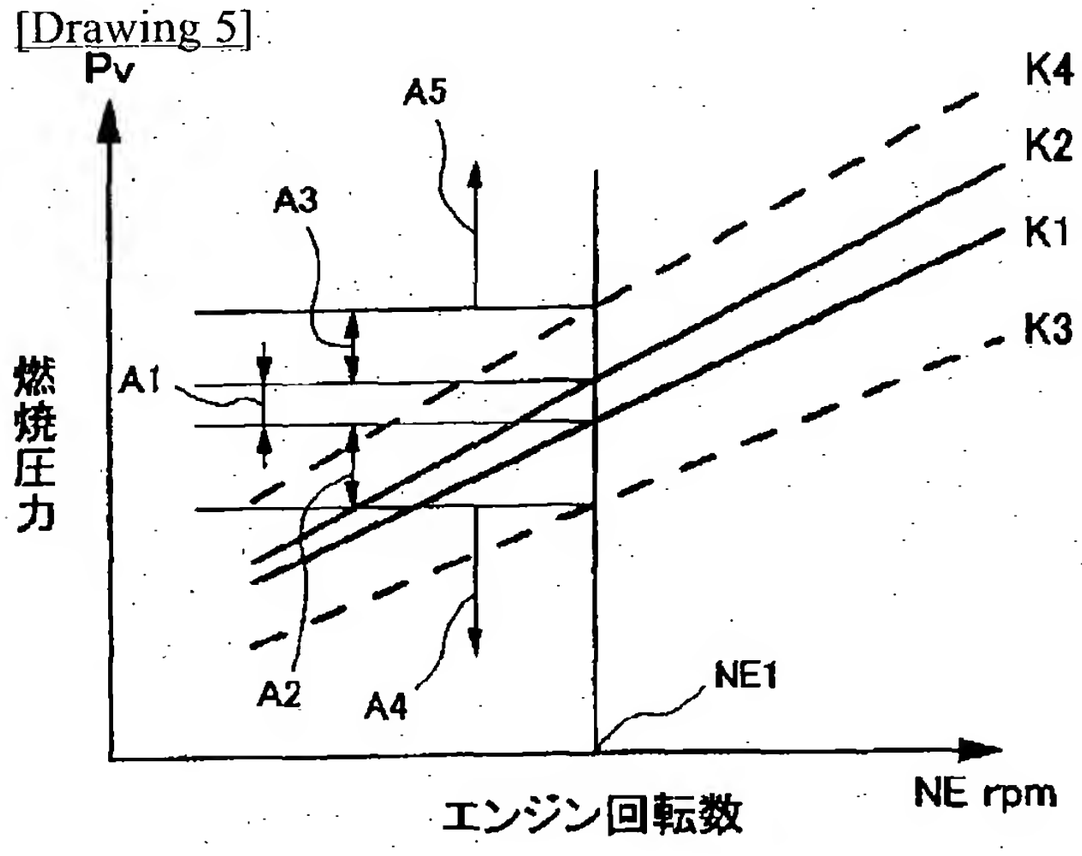
[Drawing 3]



[Drawing 4]



[Drawing 5]



[Translation done.]